THE SPATANGOID ECHINOID *LINTHIA* FROM THE LATE EOCENE OF SOUTHERN AUSTRALIA

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Summary

McNamara, K. J. (1985) The spatangoid echinoid *Linthia* from the Late Eocene of southern Australia. *Trans. R. Soc. S. Aust.* **109**(4), 161-165, 29 November, 1985.

Five specimens, one from the Late Eocene Tortachilla Limestone in South Australia, and four from the Pallinup Siltstone in south-western Australia, are described as a new species, *Linthia pulchra* sp. nov. The absence of a lateroanal fasciole is not thought to be of sufficient importance to warrant placing this species in any genus other than *Linthia*. The concept of the genus *Linthia* is emended to include forms both with and without a lateroanal fasciole.

Key Words: Spatangoid echinoid, *Linthia*, Eocene, new species, southern Australia.

Introduction

Within the Tertiary sequence of southern Australia the rich spatangoid echinoid fauna has yielded a number of forms which, at sometime or other, have been assigned to the genus *Linthia*. Tate (1885) described *Linthia antiaustralis* from the Early Miocene of the Murray River cliffs; H. L. Clark (1946) placed *Megalaster compressa* in *Linthia*; and Pritchard (1908) placed two of McCoy's (1882) species, *Pericosmus nelsoni* and *Pericosmus gigas* in *Linthia*, along with a new species, *L. mooraboolensis*. However, as discussed below, none of these species belong in the genus *Linthia*. Consequently, this common, cosmopolitan, Tertiary genus has not previously been described from Australia.

It is the aim of this paper to describe what is not only the largest known spatangoid echinoid from the Late Eocene Tortachilla Limestone in South Australia and the Pallinup Siltstone in Western Australia, but also to record the presence of *Linthia* in the Australian Tertiary.

The material upon which this paper is based consists of a single specimen from the Tortachilla Limestone in South Australia and four from the Pallinup Siltstone in Western Australia. Although the Tortachilla Limestone specimen does not have its adoral surface preserved, much of its aboral surface is in an excellent state of preservation. Three of the specimens from the Pallinup Siltstone are preserved only as internal moulds, but with both aboral and adoral surfaces preserved. The other specimen is poorly preserved and consists of an external and internal mould. Sufficient details are preserved in the five specimens to be confident that they are conspecific and represent a hitherto undescribed taxon.

Measurements on the specimens were made with a vernier calliper to an accuracy of 0.1 mm. A number of parameters are expressed as percentages of maximum test length (%TL). Specimens are housed in the collections of the Museum of Victoria (NMV); Western Australian Museum (WAM) and Geological Survey of Western Australia (GSWA).

Stratigraphy

The Tortachilla Limestone is a yellow-brown, green and grey bioclastic limestone which in outcrop in the Willunga Embayment of the St Vincent Basin, South Australia, attains a maximum thickness of 2 m in cliffs at the south end of Maslin Beach (Reynolds 1953; Cooper 1979). It is early Late Eocene in age (Ludbrook 1963; McGowran 1978; Lindsay 1985). It contains a rich marine invertebrate fauna, predominant amongst which are the echinoids. Most forms from this unit have been described, including the following: *Stereocidaris cudmorei* Philip, 1964; *S. fosteri* Philip, 1964; *S. inermis* Philip, 1964; *S. hispida* Philip, 1964; *S. intricata* Philip, 1964; *Salenidia tertiaria* (Tate, 1877) (see Philip 1965); *Ortholophus bittneri* Philip, 1969; *Tatechinus nudus* Philip, 1969; *Fibularia gregata* Tate, 1885; *Echinolampas posterocrassa* Gregory, 1890 (see McNamara & Philip 1980a); *Apatopygus vincentinus* (Tate, 1891); *Australanthus longianus* (Gregory, 1890); *Pisolampas concinna* Philip, 1963; *Giraliaster tertiarius* (Gregory, 1890); *G. bellissae* Foster & Philip, 1978; *Gillechinus cudmorei* Fell, 1964 (see McNamara *et al.* in press); *Hemiaster (Bolbaster)* sp. nov. (McNamara, in press); *Prenaster aldingensis* Hall, 1907; *Protenaster preaustralis* McNamara, 1985; *Schizaster (Paraster) tatei* McNamara & Philip, 1980b.

The Pallinup Siltstone, a member of the Werrilup Formation within the Plantagenet Group, is a siltstone of spongolite which occurs discontinuously along the southern coast of Western Australia (see Darragh & Kendrick 1980, Fig. 1). This richly fossiliferous unit is considered to have been deposited in a shallow shelf environment (Darragh

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& Kendrick 1980). Echinoids form a major part of the marine invertebrate fauna, but remain essentially undescribed. *Gillechinus cudmorei* has been recorded from the unit (McNamara *et al.* in press). Other forms present include *Schizaster (Paraster)* sp. nov.; *Prenaster aldingensis; Giraliaster bellissae;* and ?*Pericosmus* sp. Locally spines of regular echinoids are common. On the basis of the bivalve fauna, Darragh & Kendrick (1980) considered that the Pallinup Siltstone correlates with the Blanche Point Formation, Tortachilla Limestone and Browns Creek Clay. These units cover the planktonic foraminiferal zones P15-16 (Ludbrook 1973; McGowran 1978).

SYSTEMATIC PALAEONTOLOGY

Order Spatangoida Claus, 1876

Family Schizasteridae Lambert, 1905

Genus *Linthia* Desor, 1853

Emended diagnosis: Test commonly small, heart-shaped, anterior ambulacrum not petaloid, depressed with groove at margin; apical system ethmolytic, subcentral with 4 genital pores; petals of almost equal length; peripetalous fasciole sharply indented between petals; lateroanal fasciole present or absent.

Remarks: Kier (1984) has recently provided a diagnosis of *Linthia*. The southern Australian Late Eocene form accords well with this diagnosis in its possession of a depressed ambulacrum III with prominent anterior notch; ethmolytic apical system with four genital pores; petals of similar length; and indented peripetalous fasciole. However, Kier (1984) diagnosed the genus as possessing a lateroanal fasciole. Although the Schizasteridae are generally typified by their possession of both a peripetalous and lateroanal fasciole (Fischer 1966), in some genera the lateroanal fasciole is not always entire or present in all species or in all specimens of a single species (Mortensen 1951).

McNamara & Philip (1980b) have discussed the problems involved in using the characters of the fascioles in the supraspecific classification of the Schizasteridae. For example, the lateroanal fasciole may be present or absent, as in *Paraster;* only present in juveniles, as in *Abatus;* reduced or lost, as in *Brisaster;* incomplete, as in *Tripylus* and *Parabrissus;* or absent altogether, as in *Kina.*

Although species of *Linthia* typically possess a lateroanal fasciole, examples have been described in which it may be incomplete in some individuals, or missing entirely from an entire population. Gregory (1906) described *Linthia oblonga* (d'Orbigny, 1854) from the Cenomanian-Turonian of Sinai and Egypt. In this species the peripetalous fasciole is invariably preserved, but the lateroanal fasciole is either absent or present only as obscure traces. This absence is not a function of preservation as the tubercles and peripetalous fascioles are well preserved. Newton (1904) similarly observed this variability in *L. oblonga* from Sinai.

A similar situation is found in a form described by Bather (1904) from north-west Nigeria as *Hemiaster sudanensis.* This species is ethmolytic and in appearance belongs more appropriately in *Linthia.* This was also the view of Lambert & Thiéry (1925). Bather noted how specimens from certain localities show the lateroanal fasciole (for example Bather 1904, Pl. 11, Fig. 13), whilst from the other localities it is clearly absent (Bather 1904, Pl. 11, Fig. 7).

Consequently the revised diagnosis of *Linthia* presented above takes into account the ephemeral nature of the lateroanal fasciole. Although much of the test of the Tortachilla Limestone specimen described herein is very well preserved, the lateral parts of the test unfortunately suffer from extensive post-mortem encrustations of bryozoans. Consequently only one small portion of the lateral part of the test, where the lateroanal fasciole would be expected to be, is well enough preserved to indicate whether or not this fasciole is present. Close examination in this region near to the junction with the peripetalous fasciole, has revealed the absence of a lateroanal fasciole. The only specimen from the Pallinup Siltstone which shows part of the external surface (WAM 66.637) is not well enough preserved to provide corroborative evidence one way or the other. In all other aspects this species resembles a typical *Linthia,* within which genus it is therefore placed.

Linthia pulchra sp. nov.

FIG. 1

Material: Holotype, NMV P20455, from the Late Eocene Tortachilla Limestone, southern Maslin Beach, South Australia. Paratypes GSWA F5828, from the Late Eocene Pallinup Siltstone, at Stokes Brick Pit, Albany, Western Australia; WAM 66.637 from the Pallinup Siltstone at Bremer Bay, Western Australia; WAM 85.710, 85.711 from the Pallinup Siltstone near Albany, Western Australia.

Diagnosis: Test relatively narrow, maximum width anterior of centre; apical system slightly anterior of centre; ambulacrum III long, moderately depressed; anterior notch well impressed and broad; petals long and relatively narrow.

Description: Test reaching a maximum length of 80 mm; relatively narrow, width being 90.5% TL in both undistorted specimens (NMV P20455 and GSWA F5828); maximum width about one-third TL from anterior margin; height 50-54% TL, highest point slightly posterior of centre in weakly developed keel; posteriorly truncated. Anterior

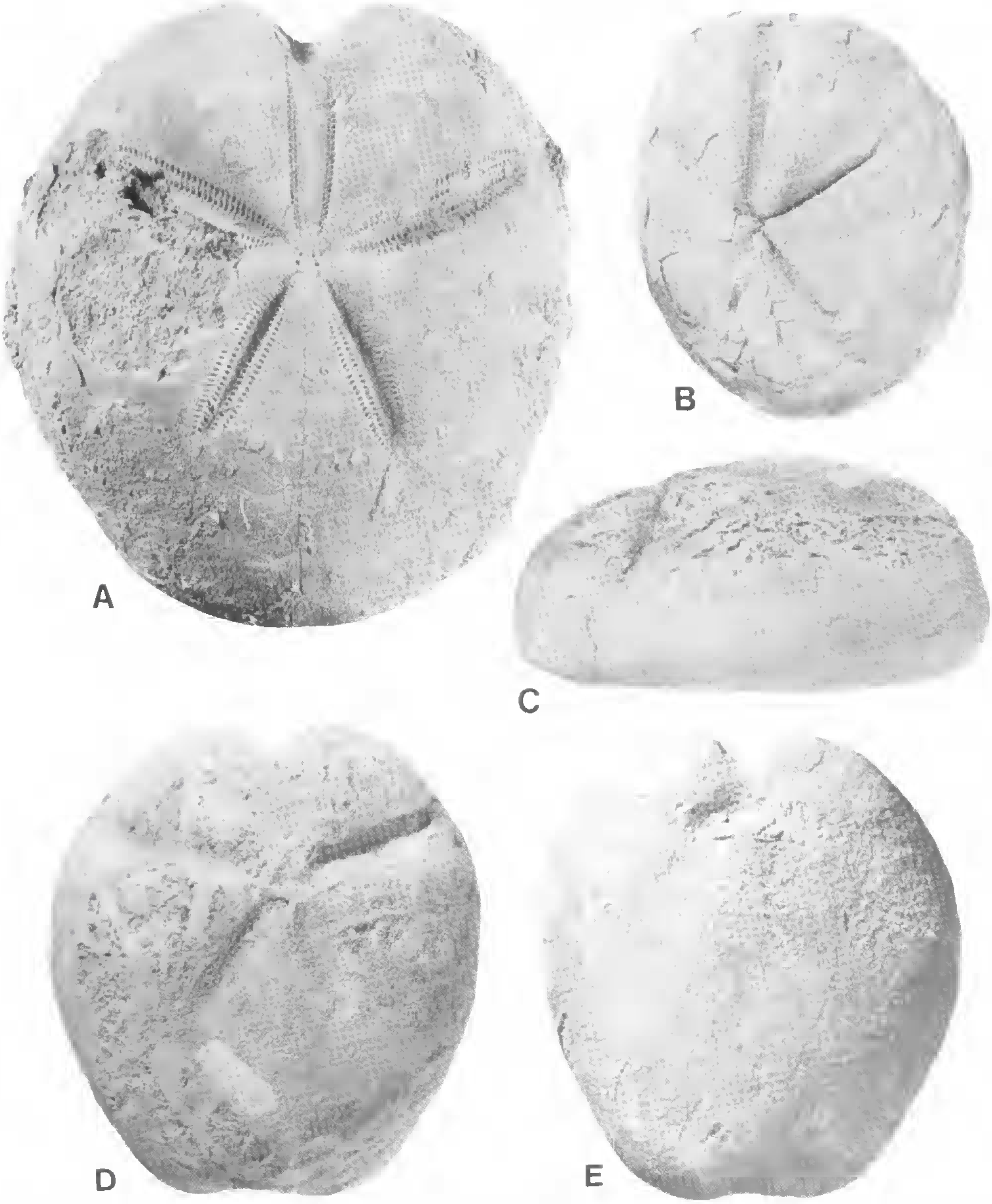

Fig. 1. *Linthia pulchra* sp. nov.; A, NMV P20455, holotype, aboral view, from the Late Eocene Tortachilla Limestone at Maslin Beach, South Australia; B, WAM 66.637, paratype, aboral view of latex cast of external mould, from the late Eocene Pallinup Siltstone, Bremer Bay, Western Australia; GSWA F5828, paratype, C, lateral view, D, aboral view, E, adoral view, from the Late Eocene Pallinup Siltstone, Albany, Western Australia; all ×1.

notch deep (8.7% TL) and broad (11.3% TL). Apical system ethmolytic with four genital pores, anterior pair being smaller than posterior pair; moderately depressed and situated 39% TL from anterior ambitus; madreporite long. Ambulacrum III depressed and broad; bearing large number (42) of pore pairs; within each pair pores aligned about 15° to transverse line and separated from each other by a prominent, swollen interporal partition. Flanks of ambulacrum III bear larger tubercles than found anywhere else on test. Floor of ambulacrum III covered by dense array of miliary tubercles. Petals deep; anterior pair diverge at about 130° and are 41% TL in length, bearing up to 44 slightly conjugate pore pairs, outer pore of which is slit-like and inner nearly circular. Posterior petals diverge at about 60° and are 31% TL long in holotype, 28% TL long in paratype, bearing up to 38 pore pairs which are similar in form to those of the anterior petals. Posterior petals slightly narrower than anterior pair, being 7% TL compared with 8% TL. Peripetalous fasciole slightly indented in interambulacra 2, 3, and 5; strongly indented in interambulacra 1 and 4.

Adoral surface slightly convex. Peristome anteriorly situated, posterior margin being situated 20% TL from anterior ambitus; semicircular in form, width 16.5% TL; slightly sunken. Labrum does not project anteriorly; constricted at one-quarter length from anterior, flaring strongly posteriorly. Plastron nearly flat; length 56% TL; width 40% TL. Periproct slightly sunken; dimensions unknown.

Discussion: Although the specimen from the Tortachilla Limestone assigned to *L. pulchra* was collected some 1800 km from those in the Pallinup Siltstone there can be little doubt that specimens from the two regions are conspecific, even though the Pallinup Siltstone specimens are largely preserved as internal moulds. The only differences between specimens from the two regions lies in the slightly flatter test and the more sunken periproct in the only complete uncrushed Pallinup Siltstone specimen.

Such a wide distribution for an echinoid taxon is not unusual in the living Australian fauna. For instance, *Breynia desorii* has a range of nearly 4000 km along the Western Australian coast (McNamara 1982). *Protenaster australis* has a similar range along the southern Australian coast (McNamara 1985). In addition to the occurrence of *L. pulchra* in both the Tortachilla Limestone and Pallinup Siltstone, *Gillechinus cudmorei* is also found in both units (McNamara *et al.* in press), as is *Prenaster aldingensis* A single incomplete specimen of *Giraliaster bellissae* is known from the Pallinup Siltstone. Foster & Philip (1978, p. 814) questioningly referred a specimen from the Tortachilla Limestone to this species. They also record it from the Late Eocene Wilson Bluff Formation near the South Australia/Western Australian border. They further note the similarity in age (planktic foraminiferal zones P14-15) between this unit and the Tortachilla Limestone (P15). The Pallinup Siltstone, as noted, lies somewhere within zones P15-16.

A number of species from the Australian Tertiary, as noted above, have been placed in *Linthia.* However, none belong in the genus. *Linthia antiaustralis* (Tate, 1885) has recently been placed in *Protenaster* (McNamara 1985). *Megalaster compressa* (Duncan, 1877) was placed in *Linthia* by Clark (1946), but is now regarded as belonging in *Pericosmus* (McNamara & Philip 1984). *Pericosmus nelsoni* (McCoy, 1882) placed in *Linthia* by Pritchard (1908), has recently been made type species of a new genus, *Waurnia* (McNamara & Philip 1984). *Pericosmus gigas* (McCoy, 1882) was also regarded as belonging in *Linthia* by Pritchard (1908). It is now considered, along with *Linthia mooraboolensis* (Pritchard, 1908) to belong in *Victoriaster.* Consequently, the Late Eocene form described herein and placed in *Linthia,* is the only unequivocal record of the genus from the Australian Tertiary.

The only Australian spatangoid which could possibly be confused with *L. pulchra* is *Protenaster philipi* McNamara, 1985 from the Late Oligocene Waurn Ponds Limestone in Victoria. *L. pulchra* can be distinguished by its lower test, more centrally located apical system, deeper ambulacrum III, broader petals and semicircular peristome. *Protenaster preaustralis* McNamara, 1985 which coexists with *L. pulchra* in the Tortachilla Limestone, is also superficially similar, but differs in its possession of a more anteriorly situated apical system; barely sunken ambulacrum III; much shallower anterior notch; longer, narrower petals, the anterior pair running almost transversely across the test.

Linthia pulchra differs from the type species *L. insignis* (Desor, 1853; see de Loriol 1876, Pl.6, Fig. 1; Pl.7; Figs 1-2) from the Eocene of Switzerland in its broader anterior petals; more anteriorly situated apical system; lower test with truncate posterior margin; and less anteriorly projecting labrum. The Middle Eocene *L. wilmingtonensis* (W. B. Clark, 1915; see Cooke 1959, Pl.29, Figs 1-4; Kier 1980, Pl.17, Figs 3-6) from North and South Carolina has, like *L. pulchra,* a deep ambulacrum III bearing many pore pairs. The two species can be distinguished by the narrower petals of *L. pulchra* and narrower ambulacrum III.

Linthia sindensis (Duncan & Sladen, 1882-6; see Lambert 1933, Pl.4, Fig. 16) from the Eocene of Pakistan and Madagascar compares with *L. pulchra.* However, the Australian species can be distinguished by its narrower petals and deeper ambulacrum III.

Jeannet & Martin (1937) illustrated a specimen from the Late Miocene of Java which they called *Schizaster* spec. aff. *subrhomboidalis* Herklots (Jeannet & Martin 1937, Fig. 61). This rather worn specimen differs from *S. subrhomboidalis* (see Gerth 1922, Pl.62, Fig. 3) in possessing a deeper anterior notch; more anteriorly eccentric apical system; and longer posterior petals. In these respects this specimen bears some resemblance to *L. pulchra.* However, its slightly shorter posterior petals and broader ambulacrum III preclude placing the two forms in the same species.

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